RESEARCH PLAN PROPOSAL

"Mobile Phone Radiation and SAR Awareness among Users"
(with Special Reference to Uttar Pradesh)

For registration to the degree of
Doctor of Philosophy

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Introduction:

Daily we are swimming in a sea of Electromagnetic Radiation (EMR) produced by various electrical appliances, overhead power lines, wiring in buildings, and other technologies that are part of the modern life. From the dishwasher and microwave oven in the kitchen and the clock next to your bed, to the cellular phone you hold close to your ears, we are getting exposed to EMR, which is dangerous and becoming a serious health risk.

Mobile phones have become very ubiquitous of late, as almost every one of us has a cell phone. In India by May, 2012, around 76% of Indian citizens were having mobile phones. But to our concern, mobile phone creates radiation when it is in use. This radiation is harmful for the human body.

Electromagnetic Radiation from mobile phones, as well as tower-based antennas carrying the signals have been found to develop health problems such as headaches, high blood pressure, brain tumors, cancer, Alzheimer's and more. The effects are cumulative and safety measures should be taken now before it is too late.

To communicate with the cellular network, mobile phones emit low levels of radio waves (also known as Radio Frequency or 'RF' energy) when being used. Governments around the world have adopted

comprehensive international safety guidelines, developed by independent scientific organizations, governing the exposure to RF energy. Mobile phones have to be designed to operate within these stringent limits as per international safety guidelines.

A mobile phone's Specific Absorption Rate (SAR) is a measure of the amount of Radio Frequency (RF) energy absorbed by the body when using the mobile phone handset. It is a measure of the maximum energy absorbed by a unit of mass of exposed tissue of a person using a mobile phone, over a given time or more simply the power absorbed per unit mass of human tissue. SAR values are usually expressed in units of watts per kilogram (W/kg) measured in either 1g or 10g of tissue. While there may be differences in SAR levels among mobile phone models, all of them must meet RF exposure guidelines. The higher the SAR the more radiation is absorbed.

This study aims at analysing the consumer awareness level as regards the Specific Absorption Rate (SAR) of mobile phone users in Uttar Pradesh. This study will also help in understanding the impact of mobile phone radiation on its users and the extent of damage or harm it does to the human body.

Review of literature:

Though not much has been contributed by the academicians and researchers about consumer awareness level of SAR on this topic, some related studies on the impact of mobile phone radiations have been undertaken in the past. These include:

Karinen, Anu, et al. (2008), in their research paper titled '*Mobile phone radiation might alter protein expression in human skin*', concluded that protein expression in human skin got affected by the exposure to Radiofrequency modulated Electromagnetic Field (RF-EMF). RF-EMF is also suspected as potential cause of such ailments as sleep disorders, headaches or allergy-like symptoms.

Leszczynski, D., et al. (2002), in their research paper *'Non-thermal activation of hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: Molecular mechanism for cancer- and blood-brain barrier- related effects*', showed that mobile phone radiations cause an increase in blood-brain barrier permeability resulting in entry of toxic substances into the blood vessel of brain that may lead to diseases like meningitis, epilepsy, sleeping sickness etc.

Ahamed, V. I., Karthick, N. G., Joseph, P. K., (2008), in their research paper '*Effect of mobile phone radiation on heart rate variability*', researched and revealed that there are reports of headache, dizziness, numbness in the thigh, and heaviness in the chest among mobile phone users.

Rassoul, G. Abdel, et al. (2007), in their paper '*Neurobehavioral effects among inhabitants around mobile phone base stations*', concluded that the prevalence of neuropsychiatric complaints as headache, memory changes, dizziness, tremors depressive symptoms, and sleep disturbance were significantly higher among exposed inhabitants than controls.

Lagovski, Vladimir and Moiseynko, Andrei, (2006), conducted an experiment in which these journalists created a simple microwave

structure. They called from one cell phone to the other and left both phones on talking mode. They placed a tape recorder next to phones to imitate sounds of speaking so the phones would stay on. It was seen:

After 15 minutes : The egg became slightly warm.
25 minutes : The egg became very warm.
40 minutes : The egg became very hot.
65 minutes : The egg was cooked.

Lean, Geoffrey, (2008), in one of his newspaper article *'Mobile phone radiation wrecks your sleep*', concluded that radiation from mobile phones delays and reduces sleep, and causes headaches and confusion. The research, sponsored by the mobile phone companies themselves, shows that using the handsets before bed cause people to take longer to reach the deeper stages of sleep and to spend less time in them, interfering with the body's ability to repair damage suffered during the day.

Wilkes, David, (2007), in one of his newspaper article '*Ten Years of Mobile Use Can Raise Cancer Risk, Say Scientists; Danger? Phones Emit Radiation*', revealed that children should be discouraged from using mobiles because their thinner skulls and developing nervous systems made them especially vulnerable.

Villafuerte, Nelly Favis, (2009), in his research paper *'Cell Phone Radiation*', showed that other sensitive organs of the body including the liver, kidneys, colon, and bladder are also affected by cell phone radiation.

Asch, Peter, (1988), in his book "*Consumer Safety Regulation: Putting a Price on Life and Limb*" is concerned that people should be educated about the bad effects of the product usages.

Justification and relevance of this study:

1. To the mobile phone manufacturers:

The market research will certainly be valuable and important for mobile phone manufacturers who will come to understand their customers needs better. The study will provide them with feedback from customers about the impact of mobile phone radiations on them and will help manufacturers to maintain SAR value of the mobile phones accordingly. This will further help them to improve their product line strength and competence. It will also provide them with information for product line restructuring.

2. To the prospective customers of mobile phone handset:

The study will provide a comparative account of the pros and cons of different mobile handsets regarding its SAR value, which will help a prospective customer in selecting an appropriate mobile handset suiting his needs. One can easily determine his needs and match them with the features available in a mobile phone handset to come to a decision about purchasing a mobile handset, best suited to his requirements and purchasing power.

3. To the distributors of mobile phones:

The following study will help the distributors to carefully analyse and choose the merchandise appropriate to usage of customers from the point of view their health.

4. **To the academicians, researchers and students:**

   The research will prove informative for academicians, students and reader interested in methods and procedures of consumer behaviour research especially for mobile phones. This research will inform them about the harmful impact of mobile phone radiations. It will help them understand the pattern of preferences and the psychological behaviour of the consumers using and buying the mobile telecommunication handsets in UP.

Objectives:

The objective of the study is to analyse the consumer awareness level about Specific Absorption Rate (SAR) and its impact on mobile phone users of UP.

These objectives can be summarised as:

1. To study mobile phone radiations and its working.
2. To analyse the harmful effects of mobile phone radiations on human body and to what extent.
3. To study the customer's viewpoints about the hazards of usage of mobile phones.
4. To study Specific Absorption Rate (SAR) and its awareness among mobile phone users.
5. To study the SAR value limits according to the established standards.
6. To study the relative market share of different mobile manufacturers, in the state of UP.
7. To study the factors that influence mobile phone purchase behaviour.

Hypotheses:

To meet the objectives of the study, following hypotheses shall be formulated and tested.

1. People are aware of SAR (Specific Absorption Rate) of mobile phones.
2. Mobile phone radiations have adverse/harmful effects on human body.
3. Consumers consider SAR value while purchasing mobile phone

Plan of work and methodology:

Data collection and Research design:

The present study will use various tools of analysis depending upon the nature, need and suitability of the data available to analyze and study the consumer awareness level and their preference.

Primary data will be collected through questionnaire from 400 respondents. The respondents will be selected by stratified sampling technique from a universe comprising of strata based on two criterions namely:

a) Gender:

Male respondents : 200

Female respondents : 200

b) Age-group:

Age-group	**No. of respondents**
16-25	100
26-35	100
36-45	100
46 and above	100

Primary data will also be collected through one to many chatting on internet, via instant messenger technique.

Secondary data will be collected from websites available on Internet, especially that of the mobile phone manufacturers. Besides, the cyber forums also serve as source of secondary data, wherein the forum members provide the relevant secondary data available with them.

The research study is more of a behavioural study and so it is qualitative as well as quantitative in nature. However, quantification of the subjective data will be done using techniques like the rating scale technique. It will include a descriptive and exploratory research

Analysis of data:

A regression and correlation analysis will be undertaken to analyze and identify the relationship between the dependent variable i.e. consumer purchase decision and the independent variable like SAR, and other mobile phone attributes. The data will be analyzed using various statistical techniques like tabulation, histograms, pie charts, measures of central tendencies etc.

Place of work and facilities available:

The present study is aimed at studying the awareness about SAR and its impact on the mobile phone users of UP. The primary data will be collected from mobile phone users in major districts of UP state.

The study will be mainly based on the primary data. In order to supplement the information reference to secondary data available on the Internet will be made besides the published and unpublished materials like the Mobile phone manufacturer's annual report, newsletters, articles, journals etc.

Limitations of the study:

The study may suffer from the common limitations of a subjective research. The quantification problem, imperfections of data and the intricacy involved in the statistical analysis are in a way inevitable in all such behavioural science researches.

Main source of data being the primary source of data, manipulation at the respondent's end cannot be averted. Effect of uncontrollable extraneous variables may also influence the respondents sub-consciously.

The published and unpublished secondary data available on Internet has its own limitations, as many of them are the author's own views and not a generalized perception. Further, the respondents often times do not portray a true picture and opinion.

The conclusions, therefore, are subject to aforesaid constraints and are only exploratory and suggestive in nature.

Chapterisation

ACKNOWLEDGEMENT

PREFACE

MOBILE TELECOMMUNICATION: AN OVERVIEW

- **a)** Mobile telecommunication system: An introduction
- **b)** Cellular systems
- **c)** Historical aspect of Mobile telecommunication
- **d)** Indian telecom industry
- **e)** Impact of mobile phone technology
- **f)** Significance of mobile phones

ELECTROMAGNETIC RADIATIONS

- **a)** Electromagnetic Radiations (EMR) : An introduction
- **b)** Mobile phone radiation working
- **c)** Mobile phone radiations and their impact on human body
- **d)** Specific Absorption Rate (SAR)
- **e)** SAR values of selected handsets
- **f)** Best lowest radiation mobile phones
- **g)** High radiation mobile phones
- **h)** Radiation free mobile phones in India

MARKET PROFILE OF MOBILE PHONES

a) Leading mobile phone handset manufacturers in India
b) Market share of mobile phone companies in India
c) UP Wireless Telecom Market 2013
d) Relative market share of different mobile phone handset manufacturers in UP.

REVIEW OF RELATED LITERATURE

RESEARCH METHODOLOGY

a) Objective statement b) Hypotheses c) Significance of the study d) Research design e) Sampling design f) Data collection g) Statistical tools and techniques used for data collection h) Scope of the study i) Limitations of study
ANALYSIS & INTERPRETATION OF DATA
FINDINGS CONCLUSIONS SUGGESTIONS
APPLICATION OF RESEARCH AND SCOPE FOR FURTHER STUDY
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ANNEXURES

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Annexure-1

Questionnaire

1. Name: _____
2. Gender

   ☐ Male ☐ Female

3. Age

   ☐ 16 - 25 yrs ☐ 26 – 35 yrs ☐ 36 – 45 yrs

   ☐ 46 yrs and above

4. Occupation: _____
5. Do you have a mobile phone?

   ☐ Yes ☐ No

6. Which brand do you prefer while purchasing mobile phone?

   _____

7. Why do you prefer this brand?

   _____

8. What is the brand of your mobile phone? Specify the model

   _____

9. Since how long have you been using the mobile phone you presently own?

   _____

10. Do you think radiations emitted during the usage of mobile phones leads to any harm?

    ☐ Yes ☐ No

If 'Yes' specify the harms.

_____

11. Are you aware of the term 'SAR' associated with mobile phone?

☐ Yes ☐ No

If 'Yes' give its full form.

_____

12. Do you consider the SAR value while purchasing mobile phones?

☐ Yes ☐ No

13. What all factors do you consider while purchasing mobile phone? Rate the factors according to the importance.

Mobile phone attributes	**Rank**
a. Brand	_____
b. Price	_____
c. SAR	_____
d. Features	_____
e. Battery	_____

14. How many hours on an average do you use your mobile phone daily?

☐ Up to 2 hours ☐ More than 2 hours

15. Do you feel any kind of uneasiness in your body after long hour usage of phone? If 'Yes', then specify them.

☐ Yes ☐ No

_____

16. How far do you keep your mobile phone while sleeping?

☐ Close to body ☐ Away

17. Do you use mobile phone while driving

☐ Yes ☐ No

18. Are you aware of the precautions to defend yourself from the harmful impact of radiations from mobile phones?

☐ Yes ☐ No

19. What all precautions do you take to protect yourself from the impact of mobile phone radiation?

a._____

b._____

c._____

d._____